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COKING OF TAMPED CHARGES.

A.M.MIROSHNICHENKO, S.E.SAMICHENKO AND YA.YU.SAPOZHNIKOV.

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It has been established that tamping should be applied to charges having a high proportion of weakly caking mostly slightly metamorphised coals.

Parallel to this it was found that charges composed of well-caking coals with but a slight participation of lean caking coals do not require tamping. Inversely, tamping of such charges leads to the deterioration of coke quality, the coke has more fissures and becomes more friable and smaller in size.

In this light, tamping coal charges spread in the countries lacking well-caking coal in sufficient quantities, such as Poland, Rumania, Czechoslovakia, etc. In England, China, and other countries having sufficient quantities of well-caking coals tamping is not favored.

In U.S.S.R. tamping of coal charges is not used. Before the War, one tamping machine was in operation at the Shoherbinovskii plant in Donbass. N.P.Chizhevskii conducted some experimental work in this plant with tamping coking charges made of Donets coals with addition of coals of the Moscow basin and slightly metamorphosized Transcaucasian coals. (1) However, the results of these coking experiments did not find any commercial application.

A tamping machine was installed in 1951 at the Karkov coke plant, where experimental coking of the standard charge containing 20% gas coal, 40% bituminous coal, 20% coking and 20% lean caking coal with and without tamping was undertaken. (2) The study showed that tamping of the standard charge led to the deterioration of coke quality: the yield of 80-66 mm. fraction of metallurgical coke dropped to 34.5% from 45.4%, the residue in the standard tumbler was reduced from 331 to 311 kilograms, the yield of the 25 mm minimum fraction under the tumbler characterizing the friability of coke increased from 49.4 to 66.2 kilograms.

It should be noted that tamping of charges considerably complicates the work of coke plants and requires large machinery.

Until recently the U.S.S.R. practice recommended for coking largely well-caking coals with a small addition of lean caking coals. On this account, there was no necessity for complicating coke production by using tamping of charges.

During the last few years and in the light of perceptible lacking of well-caking coals and also on account of the need for building coke plants in areas not having well-caking coals, a certain interest was created in respect to the use of tamping charges.

On this account we feel justified to present the results of semi-production experiments of coking charges conducted by us in 1952-1953.

These experiments were made at the Karkov coke plant in ovens 450 mm wide, 3500 mm high and 12280 mm long. Standard untamped charges were coked in 407 mm wide ovens. The quality of coals used for experimental coking is given in Table 1.

Table 1. Quality of Donets coals used in experimental coking.

Name of Coal	A	B	C	D	E
Type of Coal	D	G	K	OS	T
Technological grouping		G6	K	OS6	T
Coal quality, %					
A^c	7.15	7.72	7.36	8.13	6.28
V^c	36.52	28.00	22.28	19.22	11.36
V^g	39.35	30.40	24.00	20.90	12.20
Total S	1.94	2.36	1.96	2.15	1.19
Plastometric indices, mm					
x	48	33	18	29	--
y	0	18	17	10	--

in the Table above, the name of coal indicated by letters corresponds to the following mines:

A Mine No. 38 and No 40 of Kurakhovka
B Novo-golubovskaya
C Yasinovka (Western wing)
D Novo-kondrat'evskaya
E Mine No. 5-bis

Composition, degree of grinding, and quality of the experimental charges are given in Table 2, in which are enclosed, for comparison sake, the data bearing on conventional charges.

Table 2. Quality of experimental charges of Donets coals.

Charge composition, %							Charge quality, %			
D	G	Zh	K	OS	T	% of 3 mm, max.	W^p	A^c	V^g	S(total)
-	20	40	20	20	-	95	8.50	7.02	27.10	2.12
-	30	50	-	-	20	93	10.64	7.11	26.95	2.50
15	20	40	25	-	-	92.6	13.40	7.81	27.38	2.31

Coking conditions and the quality of the experimental coke are given in Table 3.

Table 3. Coking conditions and quality of coke made from Donets Coals.

	Charge Composition				
	Conventional		Experimental		
	20G-40Zh-20K-20S		30G-50Zh-20T	15D-20G-40Zh-25K	
	Untamped	Tamped	Untamped	Tamped	Untamped
Coking temperature, °C	1360	1370	1370	1360	1365
Coking time, hours-minutes	14-06	17-24	15-00	19-00	15-00
Coking velocity, mm/h	14.4	12.9	15.0	11.8	15.0
Size of coke, % of					
80 mm min	16.0	14.4	15.9	11.6	17.8
80-60	48.7	26.9	27.1	33.5	29.4
60-40	30.7	51.2	49.2	48.9	47.0
60 min	64.7	41.3	43.0	45.1	47.1
40 min	95.4	92.5	92.2	94.0	94.2
80-40	79.4	78.1	76.3	82.4	76.4
Residue in standard tumbler, kg	337	280	282	318	315
% of 40 mm min in tumbler residue	75.7	60.0	58.7	69.3	68.1
% of 10 mm min under the tumbler	25.3	31.0	31.0	27.0	29.0
Tests in small tumbler					
Average size by the UkhIN method	43.2	40.1	40.0	42.8	41.3
fines content " " " " ,%	12.1	12.6	15.9	11.2	14.2
40 mm min content after test,%					
100 revolutions	64.3	61.1	59.2	66.7	62.0
225 revolutions	51.1	49.1	44.0	52.4	49.2
Sapozhnikov index, 40 mm min,%	57.5	55.5	51.8	64.0	56.3

From the data presented in Table 3 it can be seen that coke produced from tamped charges containing 20% lean coal is considerably inferior in quality

to coke made from conventional production charge. The residue in a standard tumbler showed here, respectively, 280 and 337 kilograms, content of the 10 mm max. fines under the tumbler 31 and 25.3%; this coke is worse from the sizing standpoint also. No improvement was produced in the coke quality by tamping this charge. The coke residue in the tumbler and the concentration of 10 mm max. fines under the tumbler happened to be the samewith the tamped and loose charge, namely 280 and 282 kilograms and 31 and 31 kilograms.

Testing indices of the small tumbler testing show a somewhat greater strength of the coke made from tamped charges than from loose one, the yield of the 40 mm min. fraction after 100 revoluations, and particularly after 225 revolutions, of the tumbler, increased and the yield of the 10 mm max. fraction perceptibly dropped.

Tamping a charge containing 15% of weakly caking cannel coals, Table 3, markedly increased the size of coke; the yield of the 80 to 60 mm fraction and of 80-40 mm fraction became higher; the size of coke became more uniform. Testing of coke by the standard method indicated a slight improvement of the mechanical properties of it caused by tamping.

Testing this coke in a small tumbler showed that tamping of the charge leads to an appreciable improvement of the mechanical strength of the coke.

On the basis of the above remarks one can conclude that on coking charges containing weakly caking slightly metamorphosized coals the use of tamping leads to an improvement in coke quality.

It must be noted, however, that all quality indices of coke made of tamped charge containing cannel coals were considerably lower than those of coke made from standard production charge composed of Donets coals.

Different effect of tamping on qualities of coke made of charges having different compositions can be explained as follows: condensing of the charge assists a closer contact of coal particles and has an effect on gas permeability of the charge composed of weakly caking coals. This leads to an increased pressure of the gaseous products in the coal charge and increases the caking capacity of coals.